Introduction to Computer Organization – Fall 2023

Lab 1

Due: @11:55 pm, Wed September 6th via Gradescope
(You need to indicate where your answers are located on Gradescope to receive credit)

The following assignment is intended to be completed during your assigned lab period. You may work in groups of 4 or fewer people. **FOR THIS LAB ONLY,** you can pick any people for your group. After week 1, we will assign lab groups for the rest of the term.

Group names and uniqnames

Group Member Name	Uniqname
Yuzhen Chen	yuzhench

Problem 1: Conversion from Binary *[6 points]*

Convert the following Binary into Decimal, Hex, and Octal.

Binary: 0101 1010 1101

Decimal: 1453

Hexademical: 5AD

Octal (for fun): 2655

For the next 2 problems, you will need to set up your IDE.

Then, download the starter code for Lab 1:
wget https://eecs370.github.io/labs/lab1.tar.gz
When you finish these problems, submit your C files to the Autograder on Gradescope. You don't need to show anything in particular for your Gradescope submission.

Problem 2: Setting Bits in a Binary Number *[9 points, Autograded]*

Write a function `int problem2(int)` that *sets* bits 7 through 4 of the given integer **a** to be 0b1011 without changing any of the other bits.

Example:

int a = 0x0700; // … 0111 0000 0000
int result = problem2(a);
//result should = 0b… 0111 1011 0000

```
int problem2(int a){
    int first_four = a & 0b1111;
    a = a>>4;
    int target = 0b1011;
    a = a | target;
    a = a<<4;
    a = a | first_four;
    return a;
}
```

Problem 3: Masking Bits in a Binary Number *[9 points, Autograded]*

Write a function `int problem3(int)` that *extracts* bits 7 through 4 of the given integer **a.**

Example:

int a = 0x2020; // … 0010 0000 0010 0000
int result = problem3(a);
//result should = 0b0010

```
int problem3(int a){
    a = a >> 4;
    int zero = 0b1111;
    a = a & zero;
    return a;

}
```

Problem 4: Logic *[12 points]*
Answer the following questions. If you haven't taken EECS 270, you might find Wikipedia helpful.

a. Assume a is an 8-bit unsigned integer in C (usually "unsigned char") *with a=13.* What is the value of !a? What is the value of ~a?

a: 0 0 0 0 1 1 0 1
128 64 32 16 8 4 2 1
13 = 8+4+1

!a: 0 since a≠1

~a: 1111 0010

0x: F 2

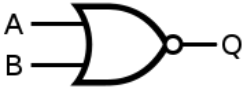
2+15×16 = 242

~a: 0b242

b. Match the logic gate to the truth table

D

B



A 

C 

A:

A	B	Q
F	F	F
F	T	T
T	F	T
T	T	T

B:

A	B	Q
F	F	T
F	T	F
T	F	F
T	T	F

C:

A	B	Q
F	F	F
F	T	T
T	F	T
T	T	F

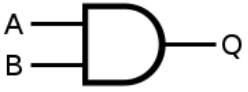
D:

A	B	Q
F	F	F
F	T	F

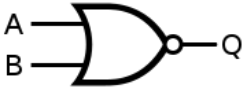
T	F	F
T	T	T

c. Write equations for the below gates. Use * for AND, + for OR ! for NOT, and () to specify order of operations. Use no other symbols.

i. Example equation: A*B



ii. Equation: A'B'

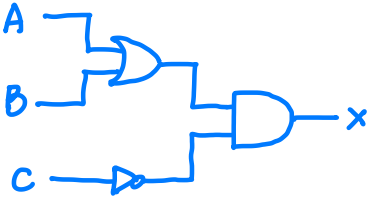


Q = (A+B)'
= A'B'

iii. Equation: A'B + AB'

Q = A⊕B = (A'B + AB')

d. Draw gates which represent X=(A+B)*!C.



Problem 5: Putting it together *[13 points]*

Consider a device which takes three inputs A, B and C and has one output, Z. It is to output a B if A=1 and it is to output C if A=0. So if A=1, B=0 and C=1 the output should be "0".

a. Write a truth table for this device.

A*(B) + A'*(C) = Q.

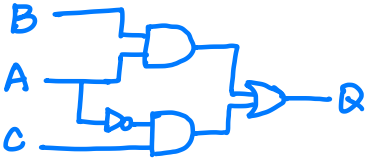
1 · 0 + 0 · 1 = 0.

Q = AB + A'C

A	B	C	Q
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

b. Using only OR, NOT, and AND gates, draw gates which implement this function.

OR: D NOT: D○ AND: D



Problem 6: Lab Survey *[1 point]*
Everyone in your group, please fill out the lab survey which will help us form groups for later assignments. It should take ~2 minutes to complete.

I will do it online